PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in or relating to the Drying of Starch

We, CORN PRODUCTS REFINING COMPANY of 17 Battery Place, New York, United States of America, a Corporation organised under the laws of the State of New Jersey, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the drying of materials existing in, or capable of being reduced to a finely divided state; and particularly to the drying of materials of an organic character which, under ordinary conditions cannot be subjected to high temperatures without injury or detrimental change.

Starch is primarily a material of this sort; and one of the objects of the invention is to provide a novel method of continuously drying starch, using air, or other drying gas, at high temperatures, so manipulated, however, that the starch is not gelatinized in spite of the fact that the air is heated to a temperature very much higher than the gelatinizing temperature of the starch; the continuous operation and the employment of high temperatures making the process quick, convenient and economical in comparison with starch drying processes now in common use. Of these common methods two are most frequently used, both being based upon the assumption that as starch containing, say 45% of water (the usual water content of starch from the washing filters), will gelatinize at about 150° F., it is not feasible to apply a drying gas to the starch at temperatures above 150° F., until sufficient water has been removed to prevent gelatinization. One common method of drying starch is the kiln method. According to this method the starch is placed on trays, or in vertical compartments having foraminous walls, and moved through drying tunnels through which heated air is moved in opposite direction to the movement of the starch, great care being taken that the air coming into contact with the 45% moisture starch should not be at the temperature above 150° F. The air may in fact enter the kiln at about 225° F., but this temperature is reduced to about 140° F. before it comes into contact with the wet or entering starch.

The other common method of drying starch involves the use of a rotary drier. The air enters the drier at about 300° F. but meets the partially dried starch. By the time the air has reached the wet starch entering the other end of the drier, its temperature has been reduced to about 140° F.

According to the method of the present invention, starch of 40%—50% water content, or less, may be dried, in a continuous operation, by contact with air heated to temperatures of 300° F., or even much higher, up to 1000° F., without producing the gelatinization or other detrimental effect. This has been found to be possible if the starch cake (the starch having a water content as above indicated and being in a moist but non-fluent state) is disintegrated by a milling operation which reduces it to a finely divided state in which the starch particles are suspended in the air through action of an air stream through the mill. In such state the evaporation of the water is so rapid that even with the drying gas at high temperatures, far beyond the gelatinizing temperature of starch, gelatinization does not take place. With the starch particles dispersed and suspended in the air, the aggregate of the surfaces at which evaporation can take place is so large that the heat of the drying gas is converted into the latent heat of evaporation, and enough of the water evaporated, all in such a short time that the starch is not gelatinized. The starch is quite as free from gelatinized particles as starch dried under the old processes. The air stream serves not only to remove the majority of the water but also to remove the finely divided starch from the disintegrating operation.

The process may also be employed on starch and water mixtures containing more water than indicated above.

A further object of the invention is to provide a system of starch drying in which there will be no escape of starch dust to the atmosphere. A starch drying operation, if the starch is dried to the usual air-dry state in which it contains about 12% moisture, produces about 5% to 10%

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of dried starch particles which are so small that they will float in the air and may be regarded as dust. These particles cannot be economically separated from the air by ordinary mechanical separators. If this dust escapes from the drying apparatus, a loss of starch results and there will be danger of starch dust explosions. According to the present process, all of the air discharged from the apparatus is substantially dust free.

The invention is illustrated, in a preferred embodiment, in the accompanying drawing which is, however, more or less diagrammatic. The appartus shown is a preferred apparatus for carrying out the process, but the process is not to be considered as limited to the use of this particular apparatus.

Referring to the drawing, A designates a mill of any preferred type, such as the hammer mill indicated, into which the starch is fed by means of the rotary feeding device B. C is an air heater connected by pipe D with the mill A. The starch cake is reduced in the mill to a finely divided state and the starch particles are put into suspension by air introduced into the mill through pipe D. Evaporation takes place instantaneously reducing the moisture content of the starch to about 20%. With this percentage of moisture, the starch is in a pulverulent state and is carried through the pipe E by fan F to the cyclone collector G which may be of usual construction. The material is damp enough, however, to be dustless at this stage, and the excess air withdrawn from the dust collector G through pipe H may be discharged to the atmosphere with no attendant disadvantage. The starch is fed by the rotary feeder I from the hopper of the dust collector into a pipe J which joins a hot air pipe K leading from the heater C to a second cyclone separator L. The air entering the mill through pipe D, and the air passing through the pipe K may be at temperatures of 300° F. or higher. The application of heat to the starch powder delivered into the pipe K further reduces the moisture in the starch to about 12%. The starch from the separator L passes through spout M to any suitable receptacle for receiving it, such as the bag N.

The starch entering the separator L will have a low enough moisture content so that there will be a certain quantity of dust too fine to be separated from the air by the separator. The air from the cyclone separator L is therefore not discharged to the atmosphere but is conducted through pipe O provided with a fan P, to the mill A, pipe O being shown as tapped into pipe D.

A practical operation of the process as applied to starch having a moisture content of 45% is as follows: 3000 cubic feet of air is drawn through the air heater per minute and heated to 300° F. 1500 cubic feet of this air passes into the mill through the pipe connection D. 1500 cubic feet passes through pipe K to the separator L. 45% moisture starch cake is fed into the mill at the rate of 16 pounds per minute. The starch entering the separator G contains 20% of moisture and the air discharged from this separator is dust free. The moisture content of the starch entering the separator L is 12%. The air discharged from the separator L and returned to the mill may contain between 5% and 10%, on dry substance basis, of the starch treated, and is recovered by being sent back to the mill A.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of drying starch in a moist but non-fluent state without substantial gelatinization of the starch in which the starch cake is subjected to a disintegrating operation to reduce it to a finely divided state and is simultaneously subjected to contact with a stream of drying gas at a temperature above the gelatinizing temperature of the starch, which stream serves both to remove the major portion of the moisture and to remove the finely divided starch from the disintegrating operation.

2. A method as claimed in claim 1 in which the starch is in a plurality of stages subjected to the action of drying gas.

3. A method as claimed in claim 1 or 2 in which the starch, when being subjected to the action of the drying gas, is in suspension therein.

4. A method as claimed in any of claims 1, 2 or 3 in which the starch is dried by the gas to a moisture content such that it is dustless.

5. A method as claimed in any of claims 1, 2, 3 or 4 in which the air and dust are separated from the starch and the dust laden air is returned to the milling operation.

6. A method as claimed in any of claims 1, 2, 3, 4 or 5 in which the temperature of the gas to which the starch is first subjected is such as will rapidly evaporate water from the starch and reduce the same to a pulverulent but substantially dustless state, for example, to a water content of about 20%, while further treatment reduces the water content, for example to 12%.

7. A method as claimed in any of the foregoing claims in which the starch has an initial moisture content not substantially in excess of 50%.

8. The method of drying starch as claimed in any of the preceding claims, substantially as described.

Dated this 30th day of June, 1939.

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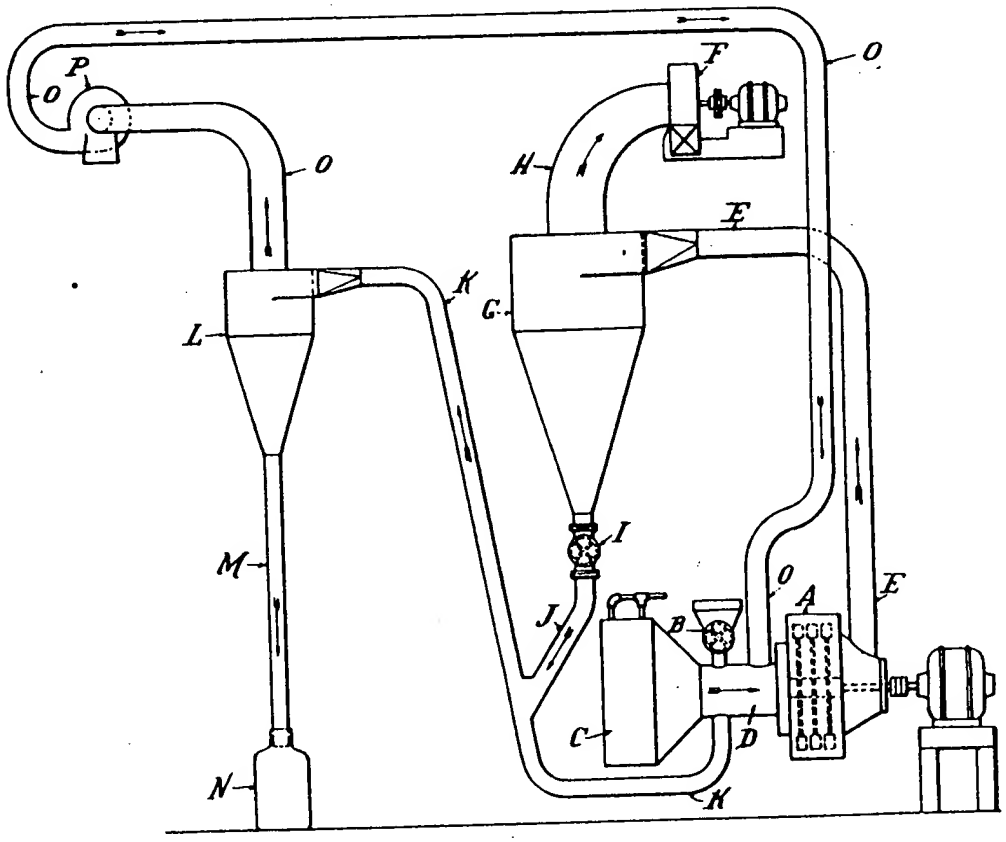

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